Editorial enquiries
The Editor | e-mail: Quest-Editor@assaf.org.za

Advertising enquiries
Barbara Spence | Avenue Advertising
PO Box 71308, Bryanston 2021
Tel: (011) 463 7940 | Cell: 082 881 3454
e-mail: barbara@avenue.co.za

Subscription enquiries and back ssues
Tsepo Majake | Tel: (012) 349 6645
e-mail: tsepo@assaf.org.za

Published by the
Academy of Science of South Africa (ASSAf)
PO Box 72135, Lynnwood Ridge 0040

Subscription rates
(4 issues and postage)
(for other countries, see subscription form)
Individuals/Institutions - R145.00
Students/schoolgoers - R72.00

Design and layout
Garnett Design Studio

Printing
Seriti Printing Digital

Website and social media
https://questonline.org.za
Twitter:@questSA1
Facebook: Quest: Science for South Africa

Cover image
NASA/Timothy Marvel

Lidar is coming of age

When Apple unveiled the iPhone 12 range in October 2020, one of the major upgrades in the Pro and Pro Max models was the addition of a lidar sensor, initially introduced in the iPad Pro, launched just over six months earlier. Apple says the sensor not only improves focusing for low-light photos and videos, but also creates precise 'depth maps' for image-processing as well as augmented reality (AR) apps that rely on 3D scanning and mapping of objects and rooms.

Lidar stands for Light Detection and Ranging, and while you'll often see it written as LiDAR, most dictionaries treat it in the same way as radar and sonar, which were originally coined as acronyms for Radio Detection and Ranging and Sound Navigation and Ranging, respectively. All are based on the same principle, determining distance to a target from the 'round trip' of a signal that is reflected off the target. While radar uses radio waves and sonar uses sound in much the same way that echolocating bats 'see' obstructions and insect prey in the dark, lidar relies on light from a laser – a word that is itself derived from the acronym for Light Amplification by Stimulated Emission of Radiation.

Most lidar systems use either the time-of-flight or the phase-shift method. In the first, most common for long-distance ranging, distance to the target is calculated from the time taken for a light pulse to return to the sensor (distance = [speed of light x time-of-flight] / 2). Phase-based systems, on the other hand, use a continuous, modulated laser beam and determine distance from the phase difference, or shift, between the sent and received signal.

Lidar serves as an 'eye' in many robotic devices, including those used in some parts of the world during the COVID-19 pandemic to sanitise hospital rooms, deliver supplies, monitor body temperatures and encourage social distancing. It is also a key component of most 'self-driving' autonomous vehicles, although Elon Musk famously called it 'a fool's errand', preferring to use a combination of cameras, radar and ultrasonic sensors in his Tesla cars.

Lidar is increasingly used to measure volume of material on conveyor belts, and has been heavily adopted by the mining industry for this purpose and others. For example, airborne lidar is used to detect and monitor subsidence of the ground surface at local mines, while scientists at the CSIR have combined lidar and ground-penetrating radar on an autonomous robot to find and map faults in rock faces, which pose a safety concern to miners working underground.

Lidar has helped find and map ancient 'lost cities' around the world, and even on the Suikerbosrand hills near Johannesburg (see *Quest* 14:4). South African scientists and resource managers have also used it for mapping natural vegetation and crop-type, assessing biomass, monitoring air quality and predicting flood levels, among other endeavours. In this issue, we explore these and other scientific applications of lidar.

Sue Matthews
Quest Editor

Isihloko saloludaba yi 'lidar', yona esebenzisa ukukhanya ukulinganisa ibanga phakathi kwayo nezinye izinto, ngendlela efanayo amalulwane asebenzisa umsindo 'ukubona' okungaphazamisa endleleni yazo nokuthola izilwanyana ezindiza phambi kwazo. Ngaphandle kokusetshenziswa kwi technology njengezimoto ezizishayelayo, ama robots, ilidar inemisebenzi eminingi kakhulu kweze science njengokwakhiwa kwama map yemihlaba nokuqinisekisa ukuphepha komoya.

Translated by Mbali Nguse

2020-11-30

Quest Volume 16 Number 4 2020

Academy of Science of South Africa (ASSAf)

Academy of Science of South Africa (ASSAf)